[redacted]

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 4314C:ANB:NXL	**FOR FURTHER ACTION**	See Form PCT/IPEA/416
International application No. PCT/AU2004/001826	International filing date *(day/month/year)* 24 December 2004	Priority date *(day/month/year)* 24 December 2003

International Patent Classification (IPC) or national classification and IPC

Int. Cl.

C04B 18/14 (2006.01) ***C02F 1/42*** (2006.01)

Applicant

MT ASPIRING GEOCHEMISTRY CONSULTANTS PTY LTD et al

This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.

This REPORT consists of a total of 3 sheets, including this cover sheet.

This report is also accompanied by ANNEXES, comprising:

a. [X] *(sent to the applicant and to the International Bureau)* a total of **4** sheets, as follows:

- [X] sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
- [ ] sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.

b. [ ] *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or table related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

This report contains indications relating to the following items:

- [X] Box No. I Basis of the report
- [ ] Box No. II Priority
- [ ] Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- [ ] Box No. IV Lack of unity of invention
- [X] Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- [ ] Box No. VI Certain documents cited
- [ ] Box No. VII Certain defects in the international application
- [ ] Box No. VIII Certain observations on the international application

Date of submission of the demand 19 October 2005	Date of completion of this report 12 January 2006
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer **Chris Burton** Telephone No. (02) 6283 2559

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/AU2004/001826

ox No. I Basis of the report

With regard to the **language**, this report is based on:

[X] The international application in the language in which it was filed

[ ] A translation of the international application into , which is the language of a translation furnished for the purposes of:

- [ ] international search (under Rules 12.3(a) and 23.1 (b))
- [ ] publication of the international application (under Rule 12.4(a))
- [ ] international preliminary examination (Rules 55.2(a) and/or 55.3(a))

With regard to the **elements** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

[ ] the international application as originally filed/furnished

[X] the description:

pages **1-49, 54** as originally filed/furnished
pages* received by this Authority on with the letter of
pages* received by this Authority on with the letter of

[X] the claims:

pages as originally filed/furnished
pages* **50-53** as amended (together with any statement) under Article 19
pages* received by this Authority on with the letter of
pages* received by this Authority on with the letter of

[X] the drawings:

pages **1/6 – 6/6** as originally filed/furnished
pages* received by this Authority on with the letter of
pages* received by this Authority on with the letter of

[ ] a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3. [ ] The amendments have resulted in the cancellation of:

- [ ] the description, pages
- [ ] the claims, Nos.
- [ ] the drawings, sheets/figs
- [ ] the sequence listing *(specify)*:
- [ ] any table(s) related to the sequence listing *(specify)*:

4. [ ] This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- [ ] the description, pages
- [ ] the claims, Nos.
- [ ] the drawings, sheets/figs
- [ ] the sequence listing *(specify)*:
- [ ] any table(s) related to the sequence listing *(specify)*:

* *If item 4 applies, some or all of those sheets may be marked "superseded."*

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/AU2004/001826

ox No. V **Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

. Statement

Novelty (N)	Claims **1-28**	**YES**
	Claims	**NO**
Inventive step (IS)	Claims **1-28**	**YES**
	Claims	**NO**
Industrial applicability (IA)	Claims **1-28**	**YES**
	Claims	**NO**

:. Citations and explanations (Rule 70.7)

NOVELTY (N) and INVENTIVE STEP (IS) Claims 1-28

The following documents were cited by the International Search Report as being particularly relevant:

a. WO 2002/089940

b. US 5931772

c. SU 1595823

These documents all disclose compositions that comprise a cementitious material and some form of bauxite refinery residue. The claims as amended now define the bauxite refinery residue as comprising partially neutralised red mud pre-treated with water having a specific hardness.

None of the cited documents clearly disclose all of these features.

As a result, the invention defined by the claims is considered to be novel and to posses an inventive step.

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION CONCERNING WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY AND AMENDMENTS OF CLAIMS

(PCT Rule 62 and Administrative Instructions, Section 417(d))

To:

IP Australia
P.O. Box 200
Woden, ACT 2606
Australia

in its capacity as International Preliminary Examining Authority

Date of mailing (day/month/year)	
11 November 2005 (11.11.2005)	
International application No.	International filing date (day/month/year)
PCT/AU2004/001826	24 December 2004 (24.12.2004)

Applicant

MT ASPIRING GEOCHEMISTRY CONSULTANTS PTY LTD et al

The International Bureau hereby transmits a copy of the amendments to the claims under Article 19 together with any accompanying statement (Rule 62.1(ii)).

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 338.87.40

Authorized officer

Véronique Bellour

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AMENDED CLAIMS

[received by the International Bureau on 27 April 2005 (27.04.05);
original claims 1-28 replaced by amended claims 1-28 (4 pages)]

CLAIMS

1. A porous particulate material for treating a fluid containing a contaminant, the particulate material comprising a mixture of a cementitious material and a partially neutralised red mud , wherein the partially neutralised red mud has been pre-treated by contacting it with water having a total hardness supplied by calcium, magnesium or a combination thereof, of at least 3.5 millimoles per litre calcium carbonate equivalent.

2. A porous particulate material as claimed in claim 1, wherein the volume of the pores is between 10% and 90% of the volume of the particulate material.

3. A porous particulate material as claimed in claim 1, wherein at least 10 % of the pores are open cell or interconnected pores.

4. A porous particulate material as claimed in claim 1, wherein the pores of the particulate material have a distributed pore size.

5. A porous particulate material as claimed in claim 1, wherein the pore size of the particulate material is within the range of 0.1 to 2000 μm.

6. A porous particulate material for treating a fluid containing a contaminant, the particulate material comprising a coherent mass of particles, each of which comprises a mixture of a cementitious material and a partially neutralised red mud, wherein the partially neutralised red mud has been pre-treated by contacting it with water having a total hardness supplied by calcium, magnesium or a combination thereof, of at least 3.5 millimoles per litre calcium carbonate equivalent.

7. A porous particulate material as claimed in claim 6, having a form selected from the group consisting of granules, pellets, briquettes, extrudites, gravel, cobbles, blocks, interlocking blocks and slabs.

8. Use of a reactive permeable barrier or a reaction/filter column comprising a permeable mass of porous particulate materials according to claim 1 or claim 6, in the treatment of a fluid containing a contaminant, wherein the permeable mass of porous particulate materials is disposed within a flow path of the fluid containing the contaminant.

9. A composition for forming porous particulate material for treating a fluid containing a contaminant, the composition comprising bauxite refinery residue and a cementitious binder, wherein the cementitious binder is present in a sufficient quantity to form a porous particulate material according to claim 1 or claim 6.

10. A composition for forming porous particulate material for treating a fluid containing a contaminant, the composition comprising bauxite refinery residue and a cementitious binder, wherein the cementitious binder is present in a sufficient quantity to form a porous particulate material according to claim 1 or claim 6, the composition further comprising a pore generating

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agent capable of generating pores within the particulate material upon mixing the composition in an aqueous medium.

11. A composition for forming porous particulate material for treating a fluid containing a contaminant, the composition comprising bauxite refinery residue and a cementitious binder, wherein the cementitious binder is present in a sufficient quantity to form porous particulate material according to claim 1 or claim 6, the composition further comprising a pore generating agent capable of generating pores within the particulate material upon mixing the composition in an aqueous medium, wherein the pore generating agent is selected from hydrogen peroxide, organic polymers and a foaming agent.

12. A composition for forming porous particulate material for treating a fluid containing a contaminant, the composition comprising bauxite refinery residue and a cementitious binder, wherein the cementitious binder is present in a sufficient quantity to form porous particulate material according to claim 1 or claim 6, the composition further comprising a phosphorising agent.

13. A method for producing porous particulate material for treating a fluid containing a contaminant, the particulate material comprising a coherent mass of particles, the method comprising:

(a) partially neutralising red mud by contacting it with water having a total hardness supplied by calcium, magnesium or a combination thereof, of at least 3.5 millimoles per litre calcium carbonate equivalent;

(b) mixing the partially neutralised red mud with a cementitious binder in an aqueous medium to form a slurry; and

(c) curing the slurry for a period of time sufficient to form the porous particulate material.

14. A method for producing a porous particulate material for treating a fluid containing a contaminant, the particulate material comprising a coherent mass of particles, the method comprising:

(a) partially neutralising red mud by contacting it with water having a total hardness supplied by calcium, magnesium or a combination thereof, of at least 3.5 millimoles per litre calcium carbonate equivalent;

(b) mixing the partially neutralised red mud with a cementitious binder in an aqueous medium to form a slurry; and

(c) curing the slurry in a mould to form a coherent mass of the porous particulate material, wherein the mould is shaped to impart to the porous particulate material a form selected from the group consisting of granules, pellets, briquettes, extrudites, gravel, cobbles, blocks, interlocking blocks and slabs.

15. A method for producing porous particulate material for treating a fluid containing a contaminant, the particulate material comprising a coherent mass of particles, the method comprising:

(a) partially neutralised red mud by contacting it with water having a total hardness supplied by calcium, magnesium or a combination thereof, of at least 3.5 millimoles per litre calcium carbonate equivalent;

(b) mixing the partially neutralised red mud with a cementitious binder in aqueous medium to form a slurry; and

(c) curing the slurry for a period of time sufficient to form the porous particulate material,

wherein a phosphorising agent is added in step (a) and mixed with the residue and the binder to assist in stabilisation of the pore structures during curing.

16. A method as claimed in claim 13, 14 or 15, wherein the slurry comprises from about 1% to about 99% w/w of bauxite refinery residue and from about 1% to about 99% w/w of a cementitious binder.

17. A method as claimed in claim 13, 14 or 15, wherein the slurry further comprises one or more additives selected from the group consisting of sand, ground caustic steel slag residue, alkali metal hydroxides, alkali metal carbonates, alkaline earth metal hydroxides, alkaline earth metal carbonates, alkaline earth metal oxides, calcium hypochlorite, sodium alum, ferrous sulfate, ferric sulphate, ferric chloride, aluminium sulfate, gypsum, phosphates, phosphoric acid, hydrotalcite, zeolites, olivines, pyroxenes, barium chloride, silicic acid and salts thereof, meta silicic acid and salts thereof, an alunite group mineral, magadiite, a silica provider, a plasticiser, a polymeriser, a phosphatising agent, and an air entraining agent.

18. A method as claimed in claim 13, 14 or 15, wherein the bauxite refinery residue has a pH less than about 10.5.

19. A method as claimed in claim 13, 14 or 15, wherein the cementitious binder is capable of forming a tobermorite gel.

20. A method for treating a fluid containing a contaminant, the method comprising:

- providing a permeable mass of porous particulate materials according to claim 1 or claim 6; and

- passing the fluid containing the contaminant through the permeable mass of porous particulate materials.

21. A cementitious composition comprising partially neutralised red mud and cement, wherein the partially neutralised red mud has been pre-treated by contacting it with water having a

total hardness supplied by calcium, magnesium or a combination thereof, of at least 3.5 millimoles per litre calcium carbonate equivalent.

22. A cementitious composition as claimed in claim 21, wherein the cement is present in the composition in a concentration of from about 1 wt% to about 99 wt% and the partially neutralised red mud is present in the composition in a concentration of from about 99 wt% to about 1 wt%.

23. A cementitious composition as claimed in claim 21, further comprising from 0.2 wt % to 3 wt% of the cement of a super-plasticizer.

24. A cementitious composition as claimed in claim 21, further comprising a plasticiser selected from the group consisting of cellulose ethers, methyl-hydroxyethyl-cellulose (MHEC) and hydroxypropyl-methyl-cellulose (HPMC).

25. A process for the manufacture of a cementitious composition comprising

- (a) contacting red mud recovered from the Bayer Process with water having a total hardness supplied by calcium, magnesium or a combination thereof, of at least 3.5 millimoles per litre calcium carbonate equivalent, so as to obtain a partially neutralised red mud; and
- (b) mixing the partially neutralised red mud with cement so as to obtain the cementitious composition.

26. A process for the manufacture of a cementitious composition as claimed in claim 25, wherein, in step (a), the pH of the red mud is reduced to a value of at most about 10.5 and at least about 8.2.

27. A process for the manufacture of a cementitious composition as claimed in claim 25, including a step (a1), after step (a) and before step (b), in which the partially neutralised red mud is dried to obtain a dry solid material.

28. A process for the manufacture of a cementitious composition as claimed in claim 25, including a step (a1), after step (a) and before step (b), in which the partially neutralised red mud is dried to obtain a dry solid material and a further step (a2), after step (a1) and before step (b), in which the dry solid material of step (a1) is comminuted so as to obtain a partially neutralised dry, comminuted red mud.